Amendment to the Specification:

Please amend the Title of Title Page (page 1) as follows:

METHOD OF FABRICATING IRIDIUM-BASED MATERIALS AND STRUCTURES ON SUBSTRATES~~, AND IRIDIUM SOURCE REAGENTS THEREFOR~~

I. Claims Status

Claims 1-26 are pending.

II. Affirmation of Provisional Election; Cancellation of Claims 27-29 and 32 in Response to Examiner's Withdrawal of Same

In the Office Action dated February 13, 2003 the Examiner imposed a restriction requirement against claims 1-29 and 32 and required that an election be made between:

Group I: Claims 1-26, drawn to a method of fabricating an iridium-based material; classified in class 427, subclass 90+;

Group II: Claims 27-29, drawn to a microelectronic device; classified in class 428, subclass 209; and

Group III: Claim 32, drawn to a composition, classified in class 525, subclass varies.

In response, applicant hereby affirms the election, with traverse, of Group I method claims 1-26, made by Attorney Oliver Zitzmann on June 7, 2002. And consistent with the Examiner's withdrawal of non-elected claims 27-29 and 32, such withdrawn claims have been cancelled herein. The requirements of 37 CFR §1.48 are noted, and no change in the originally stated inventorship for this application is required.

The cancellation of claims 27-29 and 32 herein is with express reservation of the right to file divisional application(s) directed to the subject matter thereof, during the pendency of the present application or a further divisional or continuation application based on and claiming the priority of the instant application.

III. Amendment to Title of the Invention

In the February 13, 2003 Office Action, the Examiner required that applicant provide a new title indicative of the claimed invention.

In response, applicant amends herein the Title on Page 1 of the present application to delete the wording directed to "Iridium Source Reagents" as iridium source reagents are not descriptive of the present method claims, which are currently undergoing examination.

IV. Response to Claim Rejections Under 35 U.S.C.§ 112

In the February 13, 2003 Office Action, claims 5, 9, 11 and 23 were rejected under 35 U.S.C.§ 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Examiner states,

> **The claims recite a Lewis base, 'L', however, fail to disclose what group the Lewis base 'L' is selected from. The Examiner questions whether all Lewis Bases could be used and hence, the claim is broader than the enabling disclosure.**

In response, applicant traverses the § 112 rejection and requests reconsideration of claims 5, 9, 11 and 23 for purposes of §112, second paragraph in light of the following discussion.

According to MPEP 2111:

> **When the specification states the meaning that a term in the claim is intended to have, the claim is examined using that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to the prior art.**

Applicant clearly defines the term "Lewis base" to mean "a compound or chemical moiety that forms a bond by donating a pair of electrons" (page 11, first paragraph). Applicant provides further defining support for the term on page 6, first paragraph, reproduced below:

> **In such dry etching of a deposited iridium or iridium oxide film, the etch rates can optionally be enhanced through the use of Lewis-based adducts or electron back-bonding species such as carbon monoxide, trifluorophosphine, trialkylphosphines or other suitable Lewis base.**

Still further, in describing the limitations of the particular iridium compositions depicted as formulas I and II in the present application, "L" is defined to mean "a **coordinating Lewis base**" and both formulas I and II are identified as "**Lewis base stabilized** Ir(I) ß-diketonates" and "**Lewis base stabilized** Ir(I) ß-ketoiminates" respectively and defines families of molecules

having **electron back-bonding, coordinating ligands** capable of **stabilizing** the Ir(I) ß-diketonates and ß-ketoiminates as: alkene, diene, cycloalkene, cyclodiene, cyclooctatetraene, alkyne, substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, tetrahydrofuran, glyme, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane.

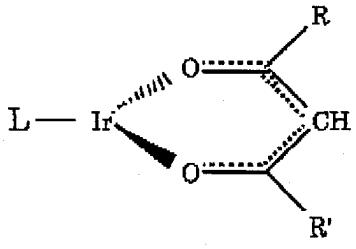
There is no infirmity in such claims under the clear and definiteness criterion of 35 U.S.C. §112, second paragraph as the term "Lewis base" as used in the present application is readily understood by those skilled in the art, since those skilled in the art readily know what the term "Lewis base" means as shown.

The foregoing should therefore be considered in respect of the clear and precise knowledge in the art of what a Lewis base is, and the chemical simplicity of forming the Ir(I) coordination complexes of applicants' claimed invention. Such consideration should then be focused on the applicable standards for enablement.

The effort needed to make and use the Lewis base Ir(I) complexes of applicants' invention is reasonable and straightforward, given the teachings of the present disclosure.

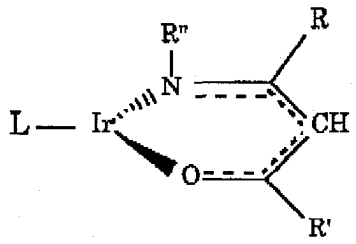
As to the alleged failure of applicant to provide enablement for all Lewis bases, applicants in their specification have provided illustrative Lewis base species of sufficient diversity and types ("L is a coordinating Lewis base, preferably alkene, diene, cycloalkene, cyclodiene, cyclooctatetraene, alkyne, substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane" – page 8, lines 8-12 of the instant specification) to support such recital of "Lewis base" in the instant claims.

Further, it is clear from applicant's claims 5, 9, 11 and 23 that the Lewis base that is required thereunder is a Lewis base that will produce an Ir(I) ß-diketonate of formula I:



I

or an Ir(I) ß-ketoiminate of formula II:



II

"The term Lewis base is generally accepted as a substance that forms a covalent bond by donating a pair of electrons". And as an additional rebuttal of the alleged indefiniteness of the term "Lewis base," a search of U.S. patent claims in the USPTO full-text patent database at www.uspto.gov for the years 1976 – 1999 reveals the term "Lewis base" in the claims of 668 United States patents. A review of these patents shows the term "Lewis base" to be a term that is well known and understood to those skilled in the art and their attorneys and agents, and routinely allowed by U.S. Patent and Trademark Office Examiners in patents covering widely varied chemical subject matter.

The first 10 of such 668 patents from the PTO Web site are illustratively described below with reference to the claiming of Lewis bases therein:

U.S. Patent 5,892,079 issued April 6, 1999 for "Metallocene catalysts and associated methods of preparation and use" recites in claim 1:

> **"1. A metallocene catalyst containing more than one active site, having the structure .... where... Y is a neutral Lewis base;...."**

U.S. Patent 5,891,237 issued April 6, 1999 for "Production of free flowing spheres using partially neutralized fatty acid" recites in claim 8:

> **"8. The spherical agglomerates of any of claims 2 to 7 wherein the neutralising agent is at least one Lewis base."**

U.S. Patent 5,888,957 issued March 30, 1999 for "Liquid cleaning compositions containing a negatively charged surfactant complex" recites in claim 1:

> **"1. A cleaning composition consisting essentially of: (d) 0.5% to 10% of a Lewis base, neutral polymer;..."**

U.S. Patent 5,888,956 issued March 30, 1999 for "Liquid cleaning composition consisting essentially of a negatively charged complex of an anionic surfactant and an amine oxide or alkylene carbonate" recites in claim 1:

> **"1. A cleaning composition consisting essentially of: (b) 0.5% to 10% of a Lewis base, neutral polymer;..."**

U.S. Patent 5,883,204 issued March 16, 1999 for "Solution polymerization process with dispersed catalyst activator" recites in claim 4:

> **"4. A process according to claim 1 wherein the ionic catalyst activator is represented by the following general formula: ... wherein: L* is a nitrogen, sulfur or phosphorus containing Lewis base; ..."**

U.S. Patent 5,880,323 issued March 9, 1999 for "Processes for making alpha.-olefins" recites in claim 14:

> **"14. A process for the formation of .alpha.-olefins containing 4 to 40 carbon atoms, comprising, contacting, at a temperature of about -100.degree. C. to about +200.degree. C.: ethylene and a compound of the formula ... wherein: ...Z is a neutral Lewis base wherein the donating atom is nitrogen, sulfur, or oxygen, provided that if the donating atom is nitrogen then the pKa of the conjugate acid of that compound (measured in water) is less than about 6; ..."**

U.S.Patent 5,869,583 issued February 9, 1999 for "Process for the controlled polymerization or copolymerization of (meth)acrylic and vinyl monomers and products thus obtained" recites in claim 3:

> **"3. A process according to claim 1, wherein the polymerization catalyst corresponds to one of the following general formulae:... L represents a stabilizing Lewis base ligand."**

U.S. Patent 5,866,704 issued February 2, 1999 for "3-aryl substituted indenyl containing metal complexes and polymerization process" recites in claim 1:

> **"1. A metal complex corresponding to the formula (I): ...where ... X' independently each occurrence is a neutral Lewis base ligating compound having up to 20 atoms;"**

U.S. Patent 5,866,663 issued February 2, 1999 for "Processes of polymerizing olefins" recites in claim 36:

> **"36. A process for the production of polyolefins, comprising, contacting, at a temperature of about -100.degree. C. to about +200.degree. C., one or more monomers... Z is a neutral Lewis base wherein the donating atom is nitrogen, sulfur or oxygen, provided that if the donating atom is nitrogen then the pKa of the conjugate acid of that compound is less than about 6;..."**

U.S. Patent 5,858,637 issued January 12, 1999 for "Process of preparing a photothermographic composition of enhanced photosensitivity" recites in claim 1:

> **"1. A process of preparing a photothermographic composition of enhanced photosensitivity ... gold compounds of the formula {AuL.sub.2 }.sup.+ X.sup.- or {AuLL'}.sup.+ X.sup.- wherein L is a mesoionic cyclic or acyclic thiourea ligand, L' is a Lewis base donor ligand, and X is an anion; ..."**

etc.

The foregoing evidences the fact that the term "Lewis base" is clear and distinct in its meaning. The ubiquity of routine allowances by the USPTO of patent applications containing claims reciting "Lewis base" components and ligands compellingly shows that the term "Lewis base" fully complies with the requirements of 35 U.S.C. §112, second paragraph.

It therefore is respectfully requested that the rejection of claims 5, 9, 11 and 23 on 35 U.S.C. §112 grounds be withdrawn.

V. Response to Claim Rejection Under 35 U.S.C.§ 103(a)

In the February 13, 2003 Office Action, claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C.§ 103(a) as being unpatentable over U.S. Patent No. 5,840,897 issued to Peter S. Kirlin et

al., (hereinafter referred to as "Kirlin"), U.S. Patent No. 5,763,633 issued to Brian A. Vaartstra et al., (hereinafter referred to as "Vaartstra") or U.S. Patent No. 5,096,737 issued to Thomas H. Baum et al., (hereinafter referred to as "Baum").

Specifically, Examiner Talbot states:

> **Kirlin et al. (5,840,897), Vaartstra (5,763,633) or Baum et al. (5,096,737) all teach composition including metal complex source reagents having ligand complexes for manufacturing iridium coatings for producing microelectronic devices such as DRAM or FRAM capacitors. A chemical vapor deposition process is utilized in an oxygen atmosphere and the metal complex is decomposed to form the metal coating.**

The present independent claims 1 and 16 are directed to a method of forming an iridium-containing film on a substrate, from an iridium-containing precursor, which is **decomposable** to deposit iridium on the substrate **in an oxidizing ambient environment**. Moreover, applicant's independent claims expressly require that deposition and decomposition in an oxidizing ambient environment, occur in a single step.

Kirlin broadly discloses a multiplicity of metalorganic complexes for chemical vapor deposition having a general formula MA_yX, wherein M is a y-valent metal selected from the group consisting of 52 metal species (Cu, Ba, Sr, La, Nd, Ce, Pr, Sm, Eu, Th, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Bi, Tl, Y, and Pb, Ni, Pd, Pt, Al, Ga, In, Ag, Au, Co, Rh, Ir, Fe, Ru, Sn, Li, Na, K, Rb, Cs, Ca, Mg, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo, and W), A is a monodentate or multidentate organic ligand selected from 7 types of ligands (namely, beta-diketonates, cyclopentadienyls, alkyls, perfluoroalkyls, alkoxides, perfluoroalkoxides, and Schiff bases), and X is a monodentate or multidentate ligand coordinated to M and is selected from 5 types of ligands (see Kirlin, column 3, lines 19-64). The group of source reagents covered by the general formula of Kirlin comprises more than 1820 (=52×7×5) different reagent species.

Applicant contends that there is no specific disclosure in Kirlin of depositing an iridium-containing film on a substrate, from an iridium-containing precursor, which is deposited and decomposed **in an oxidizing ambient environment,** in a single step, as expressly required by applicant's claimed invention.

Kirlin provides 47 Examples, (columns 18-30) for preparation of precursor(s) and/or deposition of films from such precursor(s). Of the 47 Examples, only Example 18, teaches CVD of a thin film useful as an electrode. Without any guidance from Kirlin, making a choice of a specific reagent and process parameters requires many experiments and testing and involves significant degrees of uncertainty, since the selection results in different metal precursors, film orientations and properties, etc. Based on Kirlin's teachings, therefore, what motivation is there, to particularly select iridium precursors for deposition and decomposition, in an oxidizing ambient environment, of an iridium containing film, where the deposition and decomposition occur in a single step, as expressly required by applicant's claimed invention. And a hypothetical combination of an iridium precursor for deposition and decomposition, in an oxidizing ambient environment, of an iridium containing film, where the deposition and decomposition occur in a single step, can only be based on an impermissible reconstructive perspective of hindsight.

Based on the foregoing, Kirlin does not provide any derivative basis for deposition and decomposition of an iridium precursor, in an oxidizing ambient environment, for formation of an iridium containing film, where the deposition and decomposition occur in a single step.

Vaartstra is directed to the deposition of Group VIII metal films by nonvolatile techniques such as spin-on coating, dip coating, or spraying. Vaartstra teaches preparation of an IrO_2 film (Example 2, column 6) from spin-coating a mixture of Ir(I)(cyclooctadiene)(2-ethylhexanoate) and excess 2-ethylhaxanoic acid, onto wafers at 1000-3000 rpm as a first deposition step and a rapid thermal oxidation at 500°C as a separate, second decomposition step.

Additionally, at column 5, lines 55-61, Vaartstra teaches

> **After a layer of the metal carboxylate complex is formed on the wafer W, the spin chuck 20 raises the wafer W to the level defined by the wafer conveying unit 26 and the wafer carrying unit 28 receives the wafer W from the spin chuck 20 and places the wafer W onto the unit 26. The wafer is then transferred for subsequent processing.**

In the process of assessing prior art, applicant's invention must be considered as a whole and not distorted by inferences based on similarities. Applicant's single-step deposition/decomposition process is unique and novel over the teachings of Vaartstra.

Vaartstra does not teach or suggest deposition, decomposition and oxidation as a single step process, but rather as two separate and individual steps. In fact, according to Vaartstra the carboxylate complex is spin coated onto the wafer W and transferred, in a separate step for rapid thermal anneal in oxygen.

Accordingly, the presently claimed one-step, deposition/decomposition process is patentably distinct from the teachings of Vaartstra's, two-step deposition, decomposition process.

Baum is directed to the "use of coordination complexes of (+1) Cu, Ag, Rh, or Ir for chemical vapor deposition (CVD) of "substantially pure metal" and teaches that in the course of the CVD process, the oxidation state of the metal goes to (0) (*See* column 2, lines 52-58). In fact, Baum teaches away from the present invention whereby in Examples 3, 4, 6 high purity silver and copper films are chemical vapor deposited from Ag(I) and Cu(I) precursors in a reducing (H_2) environment.

The present invention expressly requires that an iridium containing film be deposited and decomposed in an oxidizing ambient environment, in a single step.

Accordingly, there is no basis for a §103(a) obviousness rejection of claims 1-4, 7, 8, 13-22, 25 and 26 based on the teachings of Baum as there is no suggestion or motivation to modify Baum's process environment for depositing substantially pure metal films, to one comprising an oxygen ambient.

Based on the foregoing, the art references Kirlin, Vaartstra and Baum, which have been cited by the Examiner, do not provide any derivative basis for a method of forming an iridium-containing film on a substrate, from an iridium-containing precursor, which is **decomposable** to deposit iridium on the substrate **in an oxidizing ambient environment.** Accordingly, applicant respectfully requests reconsideration of the rejection of claims 1-4, 7, 8, 13-22, 25 and 26 under 35 U.S.C.§ 103(a) and withdrawal of same in light of the preceding discussion.

VI. Allowable Subject Matter

In the February 13, 2003 Office Action, Examiner Talbot indicated the allowability of claims 5, 6, 9-12, 23 and 24, if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

In response, applicant respectfully acknowledges the Examiner's contingent allowance of such claims and respectfully requests reconsideration of all pending claims (1-26) in light of the foregoing discussion.

VII. Petition for Three Month Extension of Time Under 37 C.F.R. § 1.136

Petition hereby is made under the provisions of 37 CFR 1.136 for a three month extension of the term for response to the February 13, 2003 Office Action, extending the term for response to June August 13, 2003.

VIII. Fees Due and Payable

In connection with applicant's Petition Under 37 CFR 1.136 for Three Month Extension of Time, a fee of $930 as specified in 37 CFR 1.17(a)(3), is hereby authorized to be deducted from the Deposit Account No. 50-0860 in the name of applicant, Advanced Technology Materials, Inc., 7 Commerce Drive, Danbury, CT 06810.

Applicant does not believe that any other fee(s) is due in connection with the foregoing. However, should the Office determine that a fee is due; authorization is hereby granted to deduct such fee from applicant's 50-0860 Deposit Account.

CONCLUSION

In view of the foregoing arguments, it is respectfully submitted that all claims 1-26 now pending in this application are patentable. The Examiner is therefore requested to reconsider all rejections and responsively issue a Notice of Allowability for this application.

In the event that any issues remain outstanding, incident to the formal allowance of the Application, the Examiner is requested to contact the undersigned agent at (203) 794-1100 ext. 4184 to discuss their resolution, so that this application may be passed to issue at an early date.

Respectfully submitted,

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